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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/695,798	10/30/2003	Atsushi Hiraiwa	XA-9967	7336
181	7590	03/17/2005	EXAMINER EVERHART, CARIDAD	
MILES & STOCKBRIDGE PC 1751 PINNACLE DRIVE SUITE 500 MCLEAN, VA 22102-3833			ART UNIT 2829	PAPER NUMBER

DATE MAILED: 03/17/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/695,798

Applicant(s)

HIRAIWA ET AL.

Examiner

Caridad M. Everhart

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. ____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 10-30-2003.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 2 recites the limitation "said silicon oxide formed ... by the plasma treatment" in lines 3-5. There is insufficient antecedent basis for this limitation in the claim from which claim 2 depends, that is claim 1, for the above recitation.

Specification

The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.



Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, and 3-6 are rejected under 35 U.S.C. 102(e) as being anticipated by Kim, et al. (US 6,391,803B1).

Kim et al disclose the steps of depositing by atomic layer deposition a layer of silicon oxide (col. 5, lines 52-60). The deposition is by the method of exposing the surface to a precursor and of treating the precursor layer with an oxygen plasma (col. 5, lines 40-43 and 54-56). There is any oxygen plasma treatment, because after the oxide layer forms, the oxygen plasma to which the surface is exposed, and which surface now has an oxide coating, is now being treated with the oxygen plasma. The atmosphere may contain water (col. 5, lines 54-55). The pressure is within the recited range (col. 4, lines 11-14).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

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consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 2 and 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim, et al as applied to claim 1.

Kim et al is silent with respect to the flow rate of the oxygen in the inert gas and with respect to the thickness of oxide formed relative to thickness of oxide formed by CVD and with respect to higher temperature.

With respect to the flow rate of oxygen relative to inert gas, it would have been obvious to one of ordinary skill in the art at the time of the invention to have flowed the inert gas at a higher rate than the oxygen, because in the case of nitriding, this is the case as taught by Kim et al (col. 4, lines 57-63).

With respect to the thickness of oxide grown, it would have been obvious to one of ordinary skill in the art at the time of the invention that this would increase with oxide treatment because it would be expected that the initial oxide grown would increase in thickness with the continued presence of oxygen plasma.

Therefore, it would have been obvious to one of ordinary skill in the art that the thickness of the oxide grown from the atomic layer deposition would have continued to increase.

With respect to the temperature, it would have been obvious to one of ordinary skill in the art at the time of the invention because this is a variable of the art, which one of ordinary skill in the art would have been able to determine.

Claims rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al as applied to claim 1 above and further in view of Ohmi, et al (US 2002/0040847A1).

Kim, et al is silent with respect to further steps such as patterning a relatively thick oxide film and the steps of forming a trench and of forming isolation .

Ohmi, et al disclose the steps of forming relatively thin oxide layers for gate oxide layers(paragraph 0005), the formation of relatively thick oxide films for isolation including trench isolation structures(paragraph 0202), the patterning of the oxide layers(paragraph 0212, for example describes one of the insulation films being removed from certain areas of the substrate). Ohmi et al also describe a plasma treatment of these insulator films(paragraph 0026) with a plasma of oxygen and krypton.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have carried out the steps of forming isolation regions, relatively thin oxidation films and relatively thick oxide films, patterning the oxide films and removing them from certain areas of the substrate and forming trench isolation because these steps are all taught by Ohmi et al and these steps are known to be necessary in the formation of memory devices as formed by Ohmi et al (paragraph 0002). Both Kim, et al and Ohmi, et al teach the treatment of oxides by plasma of oxygen and inert gas, especially krypton for the benefits to the films, such as low leakage current(Ohmi, et al paragraph 0003). One of ordinary skill in the art would therefore have found it obvious to combine the steps and the plasma treatment taught by Kim, et al with the steps taught by Ohmi, et al of forming isolation, forming relatively thick oxide, forming relatively thin oxide by oxidation, and forming trench isolation, patterning the oxide and

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treating the oxide by plasma of oxygen and krypton because these steps are necessary for the formation of semiconductor devices such as memory devices and in order to obtain the improvement of the properties of the oxides formed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Caridad M. Everhart whose telephone number is 571-272-1892. The examiner can normally be reached on Monday through Fridays 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

C. Everhart
3-10-2005


C. EVERHART
PATENT EXAMINER